

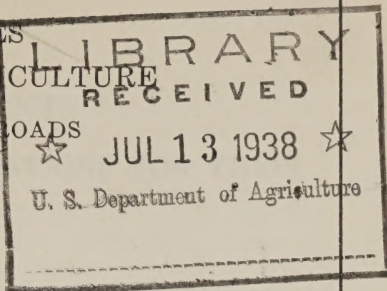
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UNITED STATES
DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS



HIGHWAY ACCIDENTS

THEIR CAUSES AND RECOMMENDATIONS
FOR THEIR PREVENTION



UNITED STATES
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HIGHWAY ACCIDENTS

THEIR CAUSES AND RECOMMENDATIONS FOR THEIR PREVENTION

In June 1936 Congress directed the Bureau of Public Roads to undertake a study of the problems involved in the advancement of safety on the streets and highways of the nation and to submit a report. Acting in cooperation with the Highway Research Board of the National Research Council there have been prepared and submitted a series of reports that have been published as House Document 462, Seventy-fifth Congress, third session, consisting of the following parts: ¹

PART 1.—Nonuniformity of State Motor-Vehicle Traffic Laws.

PART 2.—Skilled Investigation at the Scene of the Accident Needed to Develop Causes.

PART 3.—Inadequacy of State Motor-Vehicle Accident Reporting.

PART 4.—Official Inspection of Vehicles.

PART 5.—Case Histories of Fatal Highway Accidents.

PART 6.—The Accident-Prone Driver.

By making the studies in cooperation with the Highway Research Board there was made available the experience gained in previous studies by that organization, and it was possible to secure the assistance of the individuals who were already working in the several fields of investigation and who have devoted their best efforts to the studies and the resulting reports. A number of the leading authorities, representative of organizations primarily concerned in the traffic safety field, served as an advisory committee to make suggestions as to the scope of the studies and the production of the report.

In the following pages there are presented the findings and recommendations resulting from the studies.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

The problem of highway safety has become in recent years a subject of universal discussion, alarm, controversy, and recrimination. In a lesser way, it has been a subject of investigation and research. Everyone has his own ideas of what should be done about it. Some make speeches, some write to the newspapers, others express their convictions less publicly. A great many, by careful and conscientious driving, are making their individual contributions to highway safety in an eminently practical manner. Numerous organizations are interested and active in the safety field. Finally, there are determined and serious public servants, including motor vehicle administrators, highway and traffic engineers and police authorities, charged with official responsibility for the safe use of the motor vehicle, doing their best to protect life and limb on the highways.

¹These reports are available by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price of part 1 is 15 cents, and that of each of the other parts is 10 cents.

With such unanimous sentiment for safety, with so many good intentions and so many active measures taken, there can be no doubt that a vast number of accidents have been prevented. Organized safety efforts in a number of States and cities have reduced motor vehicle death rates well below the national average. Nevertheless, traffic accidents and fatalities have reached proportions that place them in the front rank of critical national problems. They involve not one but a whole series of causes and conditions, which, to be remedied, must first be understood.

Because of the wide range of possible investigations, it was necessary to select for research a limited number of subjects which seemed most urgent and most likely to yield profitable results in the brief time available. The need for an examination and appraisal of the basic data on which accident research depends was clearly indicated. It was further considered advisable to limit the detailed studies of specific accident causes to those related directly to the driver rather than to the highway or the motor vehicle.

It was impossible in the few months allowed by the act of Congress to conduct effective experiments for improvement of the details of highway design. Moreover, the Bureau of Public Roads and the State highway departments have long been engaged in the progressive application and extension of known principles in a constant effort to make the highways safer for the vehicles using them. Similarly, the automotive industry, through the producers and the technical organizations identified with it, has for many years been conducting costly experiments in an effort to improve the mechanical design of cars and trucks and to insure greater safety in their structural functioning. Finally, such imperfect records and analyses as were available at the time the research was initiated seemed to point with considerable emphasis to the individual driver and the pedestrian as the elements most directly responsible for present conditions. These are the elements about which the least is known and which are least under control.

Some of the data here reported will, it is believed, be immediately useful in the accident prevention program; some only point the way to future studies.

The most significant findings and recommendations are summed up as follows:

1. Despite recent improvement resulting from partial adoption of the vehicle code recommended by the National Conference on Street and Highway Safety, there is still an utter lack of uniformity in essential features of motor vehicle and highway law among the several States.

This finding is supported by a thorough and detailed analysis of State laws, by a study of State accident reporting, and by other studies in which State records were used as a basis. It is supported also by a study of highway patrol organization and administration, and an investigation of State requirements as to motor vehicle inspection.

2. There is an undesirable variation in the methods of recording and analyzing accident data.

This finding is supported by studies of accident reporting methods, by a detailed study of accident case histories, and by other studies requiring the use of State accident data.

3. Accidents do not result from single causes but from combinations of contributing causes.

Studies based on detailed examinations of accident case histories showed an average of at least three important contributing causes for each accident.

4. There is a relatively small group of definitely accident-prone drivers who experience a relatively large number of accidents. There is also a large group of definitely accident-free drivers.

This has been a controversial issue heretofore. A special study and a reanalysis of the best available material from previous research point conclusively to the existence of these classes of drivers.

5. Drivers in the age group of 16 to 25 years have a disproportionate share of fatal and personal-injury accidents.

This finding is supported by studies of accident data from several States.

6. Disciplining and control of delinquent drivers is in many instances strikingly deficient.

This finding is supported by a study of case histories of over 1,700 fatal accidents; also by evidence of inadequate highway policing and uncertain accident reporting.

7. Highway-police organizations, even though the personnel is efficient and conscientious in the performance of its duties, are usually so small, and so occupied with other duties as to be unable to operate effectively in motor vehicle law enforcement or accident prevention.

This finding is supported by a general study of State highway patrol personnel and duties, and by a special study of highway policing in a single State.

8. The limited compulsory inspections required in some States disclose a high percentage of improperly adjusted or inadequately maintained motor vehicles.

This is supported by a brief survey of data from 15 States.

9. Highway engineers are thoroughly aware of their obligations, and are doing all that is possible with available funds to build safe highways and reconstruct those that are unsafe.

A study of modern highway design supports this statement.

RECOMMENDATIONS

1. It is recommended that appropriate steps be taken to effect greater uniformity of motor vehicle and traffic laws, especially in essential details.

Diverse traffic regulations and rules of the road make the motor vehicle driver who has formed his driving habits in one city or State a frequent though involuntary lawbreaker when he leaves his own community. His violations of local regulations are especially dangerous because they are unintentional and unexpected. There is an obvious and urgent need for uniformity in speed laws, boulevard-stop regulations, left-turn rules, and other phases of traffic control in which it is highly important that everyone do the correct thing.

Accident-prone drivers exist, and the accident rate of youthful drivers is abnormally high. These conditions appear to warrant a uniform requirement that applicants for drivers' licenses be subjected to rigid examination. Present laws are far from uniform in this respect.

Accident records in many of the States are far from adequate. Laws regarding the reporting of accidents should conform at least to some minimum standard.

There are operating on the highways a large proportion of motor vehicles that are defective and therefore potentially dangerous, either because of poor care and maintenance, or because of bad mechanical adjustments. Only a few of the States require the official inspection of vehicles, and these vary as to type and frequency of inspection. Uniformity on some basis is desirable.

On many other matters, such as license suspensions, financial responsibility, and car accessories, the laws and regulations vary in ways that may confuse and even defeat action calculated to reduce accidents or promote alleviating conditions. These and other details should be the subject of further careful study and should be made uniform in the laws of the several States.

2. It is recommended that uniform minimum standards be developed for methods of obtaining facts regarding the occurrence of accidents and the attendant circumstances, and for methods of analysis which will more exactly recognize and interpret the facts.

Today assembled annual figures of acceptable accuracy are available for fatalities, less accurate figures are produced covering personal injury accidents, while estimates of property damage can still be made only with uncertainty. For fatal accidents the present forms of reporting in the several States can be made to serve statistical purposes. For the less serious cases, the records become correspondingly less reliable.

Much progress has been made during the last decade in gathering information, but to enable any specific measures to be taken to reduce accidents of particular types information in greater detail and accuracy is required.

Uniform accident analysis must first fix the definitions to which the facts are related. A common definition for even a fatal motor vehicle accident is not used at present.

Methods of analysis must be such as will disclose all of the apparent causes contributing to a given accident, and reported information must be sufficiently broad and complete to permit this disclosure.

3. It is recommended that a careful study be given to inspectional services as a means of assuring safe condition of cars in operation.

Inspectional services as conducted at present indicate a strong probability that an important fraction of the cars on the highway have defective lights and brakes. The general and admittedly imperfect accident statistics available point to inadequate lighting and excessive speeds as highly contributory causes of accidents. Since many drivers do not comprehend the limitations of their equipment or of their personal sensory reactions, it is of the greatest consequence that brakes and lights, at least, be kept in first-class condition.

Details as to methods of supplying or requiring inspectional services are controversial and no adequate investigations have yet been made on which such services may be satisfactorily predicated.

4. It is recommended that studies be made with a view to learning to what extent highway-patrol organizations may be expanded to advantage.

Leniency in enforcement of traffic law is probably a reflection of insufficient police control. The size of the existing forces available

for highway duties is generally insufficient; there is a lack of adequate follow-up of cases, and neglect properly to use even such records as are obtained as a result of field activities of the force. This statement is in no sense derogatory to existing personnel or administration, but has reference solely to inadequate organizations trying to do a job too big for their numbers.

SELECTION OF RESEARCH PROJECTS

The advisory committee was in general agreement on two major points: (1) That our present knowledge of fundamental facts as to how and why accidents are happening is wholly inadequate for a scientific approach to the problem; and (2) that we are weakest in our knowledge of the habits, capabilities, and limitations of the motor-vehicle driver.

The act of Congress specifically required an investigation of the status of uniform motor-vehicle legislation.

The research program chosen, therefore, gave attention to three phases of the highway safety problem:

(1) Study of State motor-vehicle laws, the lack of uniformity in which is regarded as an important contributing cause of highway accidents.

(2) Study of characteristics and habits of drivers, including the identification of dangerous drivers.

(3) Study of the basic data and means for their improvement, especially the reporting of accidents, to provide essential information on the causes of accidents.

With limited time and funds available, only a few special studies were undertaken. These were carefully planned to avoid possible duplication of work previously done or currently under way under other auspices.

STATUS AS TO UNIFORMITY OF MOTOR VEHICLE TRAFFIC LAWS

SOURCE AND DEVELOPMENT OF DATA

The registration and operation of motor vehicles in the several States is controlled by statutes and rules and regulations issued pursuant thereto. These statutes in many of the States are so prolix that it was concluded that a compilation, or even a reasonably comprehensive digest, of them would be so voluminous as to be undesirable and of doubtful value. It therefore appeared that a more clear and concise, and consequently a more useful, presentation of the extent to which there is uniformity, or lack of uniformity, in the laws of the several States could be obtained by carefully analyzing the existing laws under various topics and grouping the States according to their respective provisions under each topic.

In the study which has been made for the purpose of this report, an examination was made of the statutes of all of the States and of the District of Columbia pertaining to motor vehicles and their operation and a comparative analysis has been prepared of all those provisions which it appeared might have a bearing on the control of traffic, or on the safety of traffic, upon the highways. For convenience of expression, the District of Columbia is included in this analysis under the term "State," so that reference is made to 49 instead of 48 States.

The legislatures of 43 States were in regular session during the study and many new statutes and revisions of the existing laws relating to this subject were enacted, but very little of this new legislation could be obtained for consideration in connection with this report. It should be pointed out that many provisions of the statutes were found to be so vague and indefinite that they might be open to more than one interpretation. In addition, there may have been decisions or rulings by State administrative agencies and by the courts of the States which would give a different meaning or interpretation to some of the statutes from that given by the Bureau. It has not been possible to review such decisions or rulings of State administrative agencies or courts, as there was no known source from which they could be obtained in reasonably complete form. Neither has it been possible to assemble the rules and regulations which have been issued by the States to supplement their statutory provisions. Such rules and regulations are not easily obtainable in complete form so that one could be certain that he had them complete as in force at any particular time. It is possible therefore that a certain amount of error or inconsistency may exist in the results of the study which has been made, but it is believed that any such error or inconsistency as may exist is relatively insignificant and so slight as not to affect the general results and conclusions nor the fact that the study which has been made correctly reflects the extent to which there is uniformity, or lack of uniformity, in the laws in force in the several States pertaining to motor vehicles and their operation upon the public highways.

The analysis has been published as indicated on page 1. There is presented here only a brief summary of what it shows with respect to such topics as are believed to be of major importance from the standpoint of traffic safety, together with certain conclusions and recommendations based thereon.

The control of motor-vehicle operation so as to secure reasonable safety depends on certain fundamental requirements. Some of the more important of these requirements are the proper registration of each vehicle before it may be operated upon the highway, the licensing of drivers, safety patrol or State highway police, periodic inspection of motor vehicles, certificate of title and other antitheft provisions, restrictions on speed and driving recklessly or while intoxicated or under the influence of liquor or narcotics, rules of the road, traffic control signs or signals, operator's signals, elimination of glaring headlights, the size, load, and speed of commercial vehicles, financial responsibility of drivers, and the reporting of accidents by persons involved therein.

THE REGISTRATION OF MOTOR VEHICLES

The operation of a vehicle on the highways without valid registration and display of license plates is prohibited in all States. The administration of the laws respecting the registration of motor vehicles is vested in 7 different classes of organizations within the States, being placed under agencies that have to do with revenue and taxation in 15 States, the secretary of state in 14 States, the motor-vehicle department in 9 States, the highway department in 8 States, the department of law enforcement in 1 State, the warden of the State penitentiary in 1, and the department of licenses in 1. The procedure, however, for registering motor vehicles is substantially uniform in all States.

Applications for registration of a motor vehicle or for a certificate of title thereto shall be refused by the administrative agency in 34 States if information given by the applicant is false or fraudulent, in 38 States for failure of applicant to supply the information required, in 32 States if the vehicle is mechanically unfit, and in 41 States if the applicant is not otherwise entitled thereto.

It is made a misdemeanor in all but four States knowingly to make false statements or to conceal material facts in applications for registration or certificate of title. Such offense is made a felony in 5 States when made under oath to obtain the registration of a vehicle and in 7 States when so made to obtain a certificate of title, but only 21 States require that the application be signed by the applicant under oath.

A registration certificate or card is required to be issued in all States. It must be signed by the holder in all but six States and must be displayed in the vehicle, or be in the possession of the person in control of the vehicle, at all times.

A registration plate for both front and rear of vehicle is issued in all but three States, the latter States requiring only one plate which is to be attached to the rear of the vehicle.

The administrative agency is given general discretionary power to suspend or revoke the registration of a vehicle in 10 States. Such agency is also empowered to make such suspension or revocation in 7 States if the registration was erroneously granted, in 16 States if the vehicle has become mechanically unsafe, in 10 States if the vehicle has been dismantled and wrecked, in 9 States if the required fees and taxes have not been paid, in 12 States if the registration certificate or plates have been intentionally displayed on the wrong vehicle, and in 19 States if unlawful use has been made of the registration certificate or plates. It is specifically required in 29 States that the registration certificate and plates shall be surrendered to the administrative agency on revocation or suspension.

CERTIFICATE OF TITLE AND ANTITHEFT PROVISIONS

A certificate of title is required before a vehicle may be registered in 25 States, and a certificate of ownership or a bill of sale must be shown in 7 States. The vendor or vendee, or both, of a registered vehicle is required in 33 States to notify the State administrative agency of its transfer. Dealers are required in 10 States to notify the State administrative agency upon acquiring a registered vehicle, and 21 States require such dealers to keep a record of all such vehicles coming into their possession and provide that such record shall be open to inspection by police officers or by employees of the State administrative agency. Peace officers who learn of the theft of a motor vehicle are required in 23 States to report same to the State administrative agency. Such report should be made by the owner of a stolen vehicle in 17 States. Like reports are required of the recovery of such vehicle. The registration of a stolen vehicle is suspended for the remainder of the registration year in 12 States, until the vehicle is recovered in 10 States, for 3 years in 2 States, and for 5 years in 1 State.

State administrative agencies are required by statute in 28 States to keep indexed files of reports of vehicle thefts and of registration suspen-

sions on account thereof. Lists of stolen vehicles so reported are required to be compiled periodically in 32 States and to be distributed to peace officers therein in 22 States, and to be distributed to the proper administrative agencies of other States in 19 States.

LICENSING OF MOTOR VEHICLE OPERATORS

A permit is required in 41 States before a person may operate a motor vehicle upon the public highways. There are certain exemptions to this requirement which vary among the States and include persons operating a vehicle in the service of the United States, members of the National Guard, foreign diplomats, operators of road machinery or implements of husbandry temporarily moving upon the highways, and nonresidents properly authorized to drive by their home States. Minimum age limits are prescribed for unrestricted operators' licenses. These range from 14 years in 4 States to 18 years in 4 other States, the largest group of 25 States fixing such limit at 16 years. Of the eight States which do not require the licensing of drivers, two provide that it shall be unlawful for persons under 14 years of age to operate a motor vehicle, three fix the minimum age at 15 years and one at 16, while two have no provision on this subject. Varying minimum age limits of from 15 to 21 years are prescribed for drivers of school busses, chauffeurs, common carriers of property, and public passenger busses.

The administrative agency is given discretion in 37 States to refuse a license to any person who by reason of physical or mental disability, or other cause, would not be able to operate a motor vehicle with safety upon the highways. In addition, varying specific grounds are prescribed for which issuance of a license is prohibited. Every new applicant for an operator's permit in 30 States is required to pass such tests as are prescribed by law or regulation and to give an actual demonstration of his ability to exercise ordinary and reasonable care in the operation of a motor vehicle. Five other States do not require an examination or test, but authorize the official issuing the license to examine applicants whom he suspects of being unfit to drive. No examination or test is required in six of the States which provide for operators' licenses. The scope of examination varies in the States. For the purpose of conducting examinations or tests, the administrative agency in 14 States is authorized to designate sheriffs, chiefs of police, other local officials, or private citizens whom it deems qualified to conduct tests for this purpose. Such examinations are conducted in 18 States by full-time agents of the State administrative agency or by the State police. In three of the States in which examinations are discretionary, they are conducted, when required, by the county treasurer in one, by agents of the State administrative agency in one, and by sheriffs or chiefs of police in one.

The administrative agency is authorized and directed in 28 States to suspend or revoke the license of any resident driver upon receipt of notice of his conviction of an offense against the motor-vehicle laws of another State for which conviction in the home State would be sufficient ground for such suspension or revocation. Such agency in 29 States is also specifically authorized to suspend or revoke the driving permit of a nonresident for the same causes and in like manner as such permit of a resident may be suspended or revoked. It also is authorized in 25 States to forward a copy of the record of conviction

of a nonresident to the administrative agency of the State of residence of the person so convicted. The courts of 37 States are required to forward to the administrative agency the record of every conviction of any offense which requires the revocation or suspension of a driver's license.

Mandatory revocation or suspension of a driver's license is required for various prescribed reasons, among which are conviction of manslaughter in 30 States, or of a felony in 25 States, a motor vehicle being used in the commission of such offenses; conviction of driving while under the influence of intoxicating liquor or narcotic drugs in 36 States; conviction of failure to stop and render aid and disclose identity in event of accident resulting in personal injury or death in 31 States; upon three convictions of reckless driving in a period of 12 months in 17 States; upon two convictions within a like period in 2 States; upon three convictions within 2 years in 1 State; upon the first conviction in 5 States; and upon conviction of various miscellaneous offenses.

Varying grounds are also assigned upon which discretionary power to revoke or suspend drivers' licenses is vested in the administrative agency. The period of revocation varies, being for at least 1 year in 22 States, at least 6 months in 2 States, at least 3 months in 2 States and, for certain specific serious offenses, for the remainder of the operator's life in 5 States, for not less than 5 years in 3 States, and not less than 3 years in 2 States.

Any operator whose license has been suspended or revoked, in 25 States, is forbidden during the period of such suspension or revocation to operate a motor vehicle therein under a permit or registration certificate issued by any other State.

Penalties for driving while license is suspended or revoked vary from a minimum fine of \$10 in 3 States to a maximum of \$1,000 in 4 States, and from imprisonment for a minimum period of 2 days in 9 States to a maximum of 3 years in 1 State, jail sentence being compulsory in 15 States.

HOURS OF SERVICE OF DRIVERS OF COMMERCIAL VEHICLES

A number of States have prescribed certain limits on the hours of service of drivers of certain classes of commercial vehicles. These limitations are fixed by statute or by regulation. The maximum period that any person may drive such vehicle without rest varies from 7 to 14 hours in 34 States. When driving is not continuous the maximum number of hours that a driver may be on duty within certain specific periods, none of which exceed 24 hours, varies from 8 to 16 hours in 41 States. The minimum periods of rest which drivers must have before starting a new period of duty vary from 6 to 12 hours in 34 States.

LAWS PERTAINING TO CIVIL LIABILITY

The laws relating to civil liability of motor-vehicle owners and operators, aside from the extent to which they more clearly define the liability of such parties, are of interest from the traffic standpoint primarily for the reason that 41 States provide for service of process on nonresidents by substituted service on certain designated State officials, thus making it less easy for a nonresident to escape responsibility for an accident which he may have caused by evading service

in the jurisdiction in which such accident may have occurred. This should have some effect on nonresidents who might otherwise be disposed to be careless or indifferent under the belief that they could escape service and responsibility by passing out of the jurisdiction. More care on the part of resident owners and operators also should follow the fixing of more definite liability on them by statute. These laws also tend to curb the filing of claims for damages by gratuitous guests by providing in 27 States that liability of the owner or operator to such guests shall be limited to cases of gross negligence, wanton or reckless disregard of the rights of others, willful misconduct, or driving while intoxicated. They likewise define the liability of the owners of "for rent" vehicles and of those who may rent such vehicles.

There is a fair degree of uniformity in the statutes of the States that provide for service of process on nonresidents by substituted service on the commissioner of motor vehicles, or other designated State officer, and that limit the liability of the owner or operator of a motor vehicle to nonpaying guests. In other respects, so few States have legislation concerning civil liability and such legislation as exists varies so much that no reasonable degree of uniformity may be said to exist.

PROOF OF FINANCIAL RESPONSIBILITY

Laws imposing requirements as to the financial responsibility of the operators of motor vehicles are in force in 30 States. Nineteen of these States require proof of financial responsibility, in varying amounts, from persons convicted of violations of specified provisions of the motor-vehicle laws and from persons who fail to satisfy judgments rendered against them in cases arising out of the operation of motor vehicles. The designated offenses for which conviction makes the offender subject to the financial-responsibility laws vary considerably. Pending the furnishing of proof of financial responsibility, under the conditions named, 15 States summarily suspend the license of the operator and the registration of the vehicle involved, 10 States allow 10 days for furnishing such proof before making such suspensions, 4 States suspend only the operator's license, and 1 State suspends only the registration of the vehicle involved. Other provisions upon this subject vary so greatly that no logical grouping of them is feasible.

REQUIREMENTS IN CASE OF ACCIDENT

Every State requires the driver of a motor vehicle involved in an accident resulting in death or injury to any person to return to the scene of such accident, and in 37 States he is required to render reasonable assistance to anyone injured and if necessary to aid in getting such person to a physician or hospital. Forty-three States require the operator of such vehicle to return to the scene of accident if only property damage of various specified classes is involved, while 6 States have no provision for stopping after an accident when the resulting damage is confined to property. Upon returning to the scene of an accident, the duties of the operators involved are to a certain extent uniform in the various States.

The penalties for conviction of failure to stop after being involved in an accident are often severe, varying from fines of \$10 to \$5,000

and imprisonment for 30 days to 5 years, or both. In 31 States an operator's license also may be forfeited for this offense.

Every accident which results in personal injury or death must be reported immediately in 11 States, within 24 hours in 18 States, and within 48 hours in 3 States, while no report at all is required in 16 States. In the other State such report is required only if the accident occurred within a city or town. Accidents which involve only property damage must be reported if the apparent damage is over \$100 in 1 State, \$50 in 13 States, \$25 in 4 States, and \$10 in 2 States. In 7 States an accident which causes any damage at all must be reported. In 1 State a report is required only if a car is disabled, while in 21 States no report is required if only property damage is involved.

The reports of accidents must be made to the motor-vehicle department or corresponding agency in 16 States, while in the other States which require such reports they must be made to the police or sheriff of the jurisdiction in which the accident occurred. Supplemental reports may be required by the State administrative agency in 23 States. Such agency is authorized to prepare accident report forms and distribute them to local authorities on request in 23 States, but all accident reports are required to be on such approved forms in only 15 States. Coroners in 13 States are required to report to the State administrative agency all deaths resulting from motor-vehicle accidents, while in 2 other States this duty is imposed on local police authorities. Garages in 16 States must report vehicles brought in for repair which bear bullet holes or signs of serious collision.

The reports required in accident cases in 22 States are expressly declared to be confidential and not for public inspection or use. In 15 States the administrative agency is authorized to tabulate, analyze, and publish statistical information compiled from the reports received.

From the foregoing it will be noted that no reports of accidents are required in one-third of all of the States, and that there is a total absence of uniformity in the requirements of the other States.

TRAFFIC CONTROL DEVICES

The administrative agency is authorized in 27 States to prescribe the size, shape, and meaning of various traffic control devices, and in these States and 9 others may place them wherever it shall consider them necessary for the regulation of traffic. The laws of 2 States require that such devices shall conform as nearly as possible to those adopted in other States. Twenty-two States have enacted laws which prescribe to some extent legends for controlling the meaning of traffic-light signals, but many variations exist as between States. The resulting confusion is greatly augmented by the fact that all but 10 States specifically provide that local authorities may erect control devices within their respective jurisdictions.

DRUNKEN DRIVING

The operation of a motor vehicle by one in an intoxicated condition, or while under the influence of liquor, is made a criminal offense in every State. In general, the same provisions, including penalties, apply to driving while under the influence of narcotic drugs. In the matter of penalties for first offense, five States require imprisonment,

two States provide fines but no imprisonment, and all other States provide fine or imprisonment, or both. The penalties prescribed vary quite widely in the several States, and are increased in severity for convictions of second and third offenses in many States, imprisonment being made mandatory in 23 States for conviction of a second offense and in 4 other States for conviction of a third offense. Additional penalties provided are mandatory suspension or revocation of the right to operate a motor vehicle, either by the State administrative agency or by order of court, in 40 States for first conviction, and impounding the vehicle operated by the drunken driver in 7 States if it is registered in his name. If death or serious bodily injury results, the offense is an aggravated one in 11 States and subject to much heavier penalties ranging from 30 days' to 20 years' imprisonment as well as heavy fines.

SPEED RESTRICTIONS

The laws pertaining to speed of motor vehicles generally impose different requirements for privately operated passenger vehicles and for commercial vehicles. With respect to the speed at which privately operated passenger vehicles may be operated, 7 States have fixed maximum limits, 26 States have prima-facie limits, and 16 States have no limit in miles per hour, while in addition substantially all of the States have adopted the common-law rule that no person shall drive a vehicle at a greater speed than is reasonable and prudent under the conditions then existing. Legislation exists in 22 States concerning driving at unreasonably slow speed.

As to the speed of commercial vehicles, the limits prescribed vary widely with the type, size, and weight of load. These speeds where fixed range from 10 to 45 miles per hour, and some States provide for a graduated decrease in speed with increase in load. However, about one-third of the States make no separate provision for the speed of such vehicles, thus apparently leaving them subject to the same limits as private passenger vehicles.

The Interstate Commerce Commission, under authority of the Motor Carrier Act of 1935, issued certain regulations under date of December 23, 1936, in which the rule adopted is that the speed of common and contract carriers operating in interstate commerce shall be reasonable and prudent under the conditions which exist and shall not exceed that permitted by the jurisdiction in which the carrier is operating. In connection with the promulgation of this rule, the Commission stated that it was of the opinion that no satisfactory solution has yet been found for the problem of controlling the speed of motor vehicles upon the open highway and that it had felt impelled to refrain for the present from specifying a speed limit in miles per hour.

Reckless driving is prohibited in 41 States. The penalties for violation of the speed limits generally are less severe than for reckless driving, thus indicating that reckless driving is regarded almost everywhere as the more serious offense. They vary extensively in the different States from fines of \$1 to \$1,000 or imprisonment not to exceed 2 years, or both, for the first offense, and are increased in severity in many States for any subsequent offense.

In addition to the lack of uniformity in the laws of the several States regarding the speed of motor vehicles, the situation is further complicated and confused by the fact that the local authorities in 35 States are given varying powers to revise speed limits fixed by the State.

RULES OF THE ROAD

Concerning what are commonly referred to as the "rules of the road," it may be said that what uniformity exists is confined primarily to those fundamental requirements which prevailed before the advent of the motor vehicle; namely, that all vehicles shall be driven on the right side of the highway and shall keep to the right at all times except when passing other vehicles moving in the same direction, and that when two vehicles approach an intersection from different highways at the same time the vehicle on the left must yield the right-of-way to the one on the right. There is a notable lack of uniformity respecting other such rules, the diversity of requirements in some particulars being so marked that compliance therewith makes confusion appear inescapable. For instance, in the matter of signaling with the hand and arm, the left arm extended horizontally beyond the side of the vehicle indicates an intention to stop or suddenly decrease speed in 17 States, a left turn in 27 States, and a right turn in 14 States. In 12 of these States this signal is used to indicate any one of these movements. A forthcoming left turn is indicated by the left arm so extended and pointing to the left in 6 other States, and by holding the left arm upward in one and downward in another; and a contemplated right turn is indicated by holding the left arm upward in 16 other States, by a circular motion of the left hand in 3, and by a sweeping motion of the left arm from rear to front in 2 other States.

REQUIREMENTS AS TO LIGHTS

Motor vehicles are required by all States to be equipped with at least two head lamps and a rear light. The color of headlights is regulated by prescribing permissible colors in 19 States and by prohibiting certain specified colors in 17 States. Many States require that headlights must be visible for specified distances ahead, and that they must illuminate objects certain distances away. Glaring headlights are prohibited by statute in 37 States and in 2 other States headlights must be dimmed on approaching other vehicles. Every State requires the rear light to be red.

Certain types of commercial vehicles in 33 States are required to display clearance lights to outline their position on the highway. No uniformity as to the color of such lights or their position on vehicles exists among the States which have these requirements. Regulations recently issued by the Interstate Commerce Commission specify clearance lights which shall be displayed on all interstate common and contract carriers. The adoption of like requirements by the States would secure uniformity in this matter.

COMMERCIAL-VEHICLE SIZES AND WEIGHTS

The provisions respecting the maximum permissible length, width, height, and weight of various types of commercial vehicles differ in practically every State. Except for width limitations, there is very little uniformity in the statutes of the States pertaining to this subject. For instance, the permissible weights are determined in various States on the basis of tire width, wheel load, axle load, net load, or gross weight, either for a single vehicle or for specified combinations of vehicles. The confusion to which this leads is indicated by the fact

that the gross weight of any combination of vehicles permitted in the various States ranges from 18,000 to 120,000 pounds. Such a wide spread in permissible gross weights cannot be justified on any rational basis. A further cause for confusion arises from the fact that 19 States specifically authorize local officials to establish limitations on the size and weight of vehicles at variance with those fixed by the State.

STATE HIGHWAY PATROLS

There is provision in all but four States for some form of a State highway patrol organization. Such organization in 14 States is under the direction of a State police department, in 5 States a department of public safety, and in 4 States a separate agency created for that purpose. It is under the direction of the highway department in 12 States and the motor-vehicle department in 5 States. In five other States it is under the department of revenue. The size of the organization varies quite materially in the different States, the approximate personnel, according to the latest available data being about as follows:

Number of States	Size of force	Number of States	Size of force
1	Over 800	4	150-199
1	650-700	7	100-149
1	500-550	11	50-99
2	300-350	12	11-49
3	200-299	3	10 or less

It is obvious from the above that the personnel of the patrol organizations in more than half of the States is wholly inadequate to patrol effectively the highways and enforce the traffic laws, particularly in view of the fact that the States which have the smallest patrols are among the larger States in area. The effectiveness of such organizations in enforcing the traffic laws is further diminished in many States by the fact that they are charged with the enforcement of numerous laws which have no relation to highway safety. Enforcement of the motor-vehicle laws appears to be the major function of the patrol organization in only 22 States. In a few States such organization consists of a very small personnel concerned primarily with the collection of revenues derived from motor vehicles and their operation.

REQUIRED INSPECTION OF VEHICLES

Provision is made for periodic inspection of all motor vehicles in 22 States and of particular types of commercial vehicles in 1 other State. In six of these States this requirement is limited to specified cities or classes of municipalities. The inspections in 9 States are made by employees of the State or municipality and in the remaining States by authorized privately owned garages or service stations.

If all States would require periodic inspection of all vehicles and provide that it be made by public employees rather than by private agencies, many mechanically unsafe vehicles which now operate freely upon the highways to the serious hazard of all traffic thereon would be eliminated.

CONCLUSIONS AND RECOMMENDATIONS

The analysis which has been made of the State motor-vehicle laws clearly demonstrates an amazing lack of uniformity in such laws and the methods provided for their enforcement. This chaotic nonuniformity prevails not only in matters that are minor or relatively unimportant but also with respect to many of those provisions which are essentially fundamental in all major problems relating to traffic safety.

The only major subject upon which there may be said to be uniformity in both the statutes and their enforcement is the requirement that every motor vehicle must be registered and licensed before it may be driven upon the highways. Back of this, however, is the fact that it is a revenue measure, and were it not so, in all probability there would be many unlicensed vehicles on the highways today. The same degree of uniformity does not exist in the provisions respecting suspension or revocation of the registration of a vehicle for proper cause, nor in the methods provided for enforcing such provisions.

There is serious lack of uniformity on such major matters as the licensing of drivers, the policing of the highways, periodic inspection of vehicles, limitations on speed of private passenger vehicles and on the size, load, and speed of commercial vehicles, rules of the road, traffic-control signs or signals, operators' signals, and the reporting of accidents.

The number of automobiles of all classes shown by the records in all States in the year 1936 was 28,625,627. Every time that any such vehicle is driven upon the highway it is operated by some individual. If all of these vehicles should be operated upon the highways at the same time, it would mean that approximately one-fourth of the total population of the country would be engaged in the act of operating motor vehicles upon the highways at that particular moment.

If all drivers of motor vehicles and all pedestrians would conduct themselves continuously in a safe and prudent manner on the streets and highways, the problem of safety would largely disappear. It is generally accepted that the manner of driving a motor vehicle becomes a habit and that the involuntary reflexes largely govern the handling and control of a vehicle by each individual. The involuntary response determines the reaction of the driver in emergencies. The driving habits of the individual, with few exceptions, are formed in a single State and a single community of that State. Not only the normal habits of driving, but the involuntary reactions, which perhaps are of even greater importance, are largely the product of the laws and their enforcement by an individual State and even by a local community.

A driver with his driving habits formed in one locality, operating his motor vehicle legally, prudently, and naturally as fixed by the habits acquired under the laws of his home State, is often transformed into a lawbreaker and an unsafe driver by crossing the State line.

How then can we make progress toward a nation of safe drivers while there is such chaotic nonuniformity from State to State in both the motor-vehicle laws and in their enforcement?

Interstate traffic constitutes an important percentage of the total within each State. For certain major arteries of heavy flow, the out-of-State traffic may reach, at periods, as high as 75 percent of the

total. This actually and relatively large amount of interstate traffic creates a national problem of laws and regulations in the field of privately-owned motor vehicles that can be ignored by the Federal Government only if adequate and uniform laws and regulations are adopted by all States. This refers to major principles rather than to unimportant details.

In view of the confused situation which has been shown to exist, the following recommendations are submitted:

1. States which do not now require the licensing of motor-vehicle operators should enact such a law. Such statutes in those States where they already exist and do not require an examination and a driving test should be so revised, and all new legislation on the subject should be so drawn, as to include a rigid requirement of an adequate examination and test, such examination and test to be given by full-time examiners especially qualified for the purpose.

2. The laws of every State which do not now require compulsory reporting of accidents by motor-vehicle operators involved therein should be amended to impose such requirement in cases which result in death or personal injury, or substantial property damage.

3. States which do not now require periodic inspection of motor vehicles in order to insure their mechanical fitness for safe operation on the highways should give consideration to the advisability of enacting legislation on this subject.

4. Every State which does not now have a highway police patrol should provide for such an organization. The major duty of such patrol should be enforcement of the motor-vehicle laws pertaining to traffic. The personnel for such force should be especially trained for that purpose, and should be sufficiently large adequately to patrol the highways.

5. The laws and regulations respecting traffic should be uniform throughout each State, and any local ordinances or regulations adopted should be subject to approval by the State administrative agency before becoming effective. Local enforcement officers should be relied upon primarily in municipalities and as supplementary to the State agency.

6. The laws and regulations pertaining to the movement of vehicles upon the highways, especially the rules of the road, should be made uniform throughout all of the States.

ACCIDENT RECORDS OF DRIVERS

It has long been suspected that there is in the general population of motor-vehicle drivers a group, the members of which are much more prone to accidents than the average. This belief has been confirmed by studies of the records of drivers in commercial-vehicle fleets. What proportion these accident-prone drivers bear to the general driving public, and for what proportion of accidents they are responsible, has not been known with certainty. To obtain definite and authoritative information on these and related questions, a comprehensive research project was organized.

With the cooperation of the commissioner of motor vehicles of Connecticut, Mr. Michael A. Connor, the records of 29,531 drivers

who had been licensed in that State each year since 1931 were assembled and analyzed. These drivers were selected at random from the 408,000 who applied for license renewal in 1932. The 29,531 drivers reported collectively 7,082 accidents. Since it is recognized that not all accidents are reported to the State authorities, it is probable that some of these drivers had more accidents than appear in the records; but even if incomplete, the records are sufficient for the present analysis.

The purpose of the project was to discover something about the relative size of the accident-prone group and the proportion of accidents for which they are responsible, and whether from such records of accidents, law violations, and complaints as a licensing authority may reasonably be expected to keep, it is possible to predict the future record of a motor-vehicle operator from knowledge of his previous record.

Early in the study it became evident that the accident experience of different age groups is not the same, and the project was extended to include a study of the available information from all sources bearing on this point.

FINDINGS

1. There is a comparatively small group of definitely accident-prone drivers who have a relatively large number of accidents.

2. There is a large group of definitely accident-free drivers.

3. Predictions of future performance can be based on accident histories.

4. Drivers between the ages of 16 and 25 years have approximately one and one-half times as many fatal and personal-injury accidents as their number in the population would indicate as probable on the basis of chance.

THE ACCIDENT-PRONE DRIVER

This investigation has shown that the accident histories of individual operators can be of great value to motor-vehicle administrators. Although the records of no State may be complete in respect to non-personal accidents in which the property damage is low, nevertheless records which contain as much information as those of Connecticut are well worth the cost of obtaining them.

From these records it has been established unquestionably that there exists among the general population of drivers a small group that is definitely accident-prone, and a much larger group that is just as definitely accident-free.

Table 1 shows the 29,531 drivers classified according to the number of accidents recorded against each. There were 1,147 operators, 3.9 percent of the total, who had two or more accidents each, and who together had 2,579 accidents or 36.4 percent of all the accidents. The drivers having 3 or more accidents constituted about 0.7 percent of the total, but had 10.0 percent of the accidents. The great majority of the drivers on the other hand, reported no accidents over the 6-year period.

TABLE 1.—*Distribution of accidents among 29,531 drivers during a 6-year period*

Number of accidents per driver	Number of drivers
0.....	23,881
1.....	4,503
2.....	936
3.....	160
4.....	33
5.....	14
6.....	3
7.....	1
Total.....	29,531

Regardless of how these 7,082 accidents might have been distributed among the 29,531 drivers, it is evident that some drivers would have had more than the average for the group—each driver who had had even one accident would have had four times the average. If none had had more than one accident, we could still point out that 24.0 percent of the drivers had 100 percent of the 7,082 accidents. There is, therefore, nothing significant in the mere fact that some drivers exceeded the average, or even that some experienced two, three, or four accidents. If these same 7,082 accidents had been distributed to the same 29,531 drivers by a fair and impartial lottery, some drivers would have been so unlucky as to draw several accidents each, and it is possible to calculate mathematically just how many would have had 1, 2, 3, or more accidents under such assumed conditions. The important and highly significant fact revealed by this investigation is that the number of drivers who had two or more accidents, and especially of those who had numerous accidents, was very much greater than can be accounted for by pure chance or luck alone. In other words, there is an accident-prone group who, for various reasons, have more than their fair share of accidents. Their excess accidents cannot be explained by chance but definitely must be attributed to predisposing characteristics of the individuals or of the conditions under which they do their driving.

At the other extreme, the number of accident-free individuals is also too large to be ascribed to chance.

The conclusion is that the good, the bad, and the indifferent drivers do not acquire their respective accident records by luck alone. It seems certain that the accident-prone drivers, as a class, might well be singled out for intensive efforts directed toward reeducation or disciplinary control.

Eight previous surveys by other investigators were also studied, seven of which confirm the present results. The present investigation, however, is based on a longer experience than any earlier study of a general population, and its results serve to explain certain apparent discrepancies between earlier surveys which are actually consistent with each other.

The accident repeaters, considered as groups, behaved consistently in the two 3-year periods making up the 6-year recorded experience. The drivers who were accident-free in either half of the entire period, as compared with those who had one accident, had, in the other half of

the experience, only half as many accidents per driver as the latter group had. The disparity between the one-accident group and the groups of repeaters is even more striking. Given the group histories in one-half of such an experience as this, it is possible to predict the corresponding histories in the other half.

Most of those operators who had more than one accident repeated early. The average interval between accidents was about 15 months, but 10 percent of the intervals were less than 3 months, and 24 percent less than 6 months. For several months after one accident, a driver is actually more liable to accident than he was before.

If due regard is paid to the fact that the histories taken through a short period will identify only a part of the population who are predisposed to accidents, it should be possible to base administrative regulations upon these histories. A policy needs to be worked out with great caution, but there is little reason for doubting that the highways could be made safer if a very small proportion of the motor-vehicle operators, who are easily identifiable, were disqualified as drivers.

It was also found that the younger drivers had an undue proportion of personal accidents. In 10 samples which were studied the drivers 16 to 20 years of age had between 1.24 and 2.10 times as many fatal accidents as they would have had if accident liability were independent of age. The age group 21 to 25 had between 1.29 and 1.65 times as many fatal accidents as they were entitled to have. Their showing in nonfatal personal accidents is about as bad as in respect to fatal accidents; but in accidents which involved property damage only, the disparity is smaller. They do not appear to cause much more property damage than other classes of drivers. Thus, this survey has singled out another small part of the population against which safety efforts might well be directed. In 1932-36 the licensed drivers 16 to 20 years of age constituted but 7.40 percent of the Connecticut licensed driver population, while those 21 to 25 years of age constituted 15.75 percent. Together these drivers form 23.15 percent of the population, but in the period 1932-36 they had 35.3 percent of all the fatal accidents, 1.5 times as many as the laws of chance allow.

If the fatal-accident rate of this group could be reduced to the average for the whole population, the result would be a saving of more than one-eighth of the fatal-accident toll. A corresponding saving would be effected in respect to personal injuries.

Detailed tabulations and full discussion of the analysis and conclusions have been published as indicated on page 1.

CASE HISTORIES OF FATAL HIGHWAY ACCIDENTS

The inadequacy of summarized accident data published by the various States and cities prompted a desire to explore the possibilities of studying accident causes through detailed case histories compiled from official sources. Case histories of 1,715 fatal highway accidents were taken from official records in the States of Connecticut, Indiana, Massachusetts, Michigan, New Jersey, New York, Pennsylvania, and Rhode Island, and the cities of Cincinnati and Cleveland, Ohio; Chicago and Evanston, Ill.; Detroit, Mich.; Louisville, Ky.; Milwaukee, Wis.; and South Bend, Ind. In some cases the official records

were supplemented by information from outside sources. In general, the reports were confined to accidents that occurred in 1936, in order to give a cross section of the year's fatal accidents in each State or city.

The purpose of the research was to secure as much information as possible concerning the fundamental factors involved in highway accidents, and any possible light on accident-prevention measures. It was necessarily assumed, of course, that the facts were as reported, except where there were inconsistencies or contradictions. The records were studied statistically, but the principal object of assembling a large number of case studies was to get away from statistical analysis in the direction of more definite human factors and relationships. Each story seeks to show as clearly as possible the circumstances—physical, mechanical, and human—which resulted in a specific accident. It is only by reading over these stories in detail that the contributing factors and the resulting actions of police and motor-vehicle officials can be clearly impressed on the mind. It is hoped that this collection will show some of the weak spots in highway transportation safety factors in the various States today, and leave some suggestion of the remedies that must be applied if loss of life is to be curtailed.

FINDINGS

1. Some significant factors in the existing accident situation can be evaluated by analysis of existing public records. Other factors will require special research and analysis of technical investigations of accidents as they occur. In the former category may be placed the relative frequency of different kinds of accidents, effects of darkness, ages of persons involved, and effects of physical conditions. In the latter are the relations of speed to accidents, drivers' attitudes, and condition of vehicles.

2. Relatively few accidents can fairly be charged to any one act or condition. Accidents result from multiple contributing circumstances, an average of nearly three important causes or circumstances having been found to contribute to each accident.

3. Great leniency, lack of uniformity in disciplinary action, and frequently the absence of any such action are apparent in the cases studied.

4. The data of accidents when drawn from even the best available records are generally inadequate to show all conditions of the accident, especially with respect to the vehicle and the highway.

STATISTICAL ANALYSIS

A major purpose of this research was to test the feasibility of studying accident causes from selected accident records. Accordingly, a partial statistical analysis was made of the 892 accident case records which had been collected up to May 12, approximately half of the entire number of cases compiled during the course of the survey. The composition as to sources of the cases thus analyzed, compared with the final list at the completion of the study, is shown in table 2.

TABLE 2.—*Sources of case records on fatal highway accidents*

Source of case data	Number of cases in statistical study	Total number of cases compiled	Source of case data	Number of cases in statistical study	Total number of cases compiled
State motor-vehicle departments:			City police departments:		
Connecticut.....	85	148	South Bend, Ind.....	7	7
Massachusetts.....	151	188	Cleveland, Ohio.....	19	19
New York.....	315	348	Chicago, Ill.....	36	36
Rhode Island.....	63	90	Evanston, Ill.....	34	36
New Jersey.....		191	Milwaukee, Wis.....	29	29
Pennsylvania.....		273	Louisville, Ky.....	25	25
Indiana.....	69	69	Cincinnati, Ohio.....	59	59
Michigan.....		148	Detroit, Mich.....		49
Total.....	683	1,455	Total.....	209	260
			Grand total.....	892	1,715

The percentage distribution of this sample of accidents according to type and circumstances was compared in various ways with available estimates for the whole country, and a reasonably close agreement was found, particularly in the important groupings. It is believed, therefore, that the larger sample of 1,715 accidents may be accepted for statistical purposes as typical of fatal accidents generally.

A number of analyses of the data were made as to type of accident, circumstances, persons involved, and vehicles involved. Though this was only a hand tallying of certain major items for investigational purposes, it became evident that a complete analysis by machine tabulation would be well warranted.

It is significant that for 892 accidents there were 2,524 separate causes or circumstances tallied, or nearly 3 per accident. There were about 1.08 fatalities per accident.

Of the 892 cases analyzed 60.4 percent were collisions of motor vehicles with pedestrians, 20.0 percent collisions of two or more motor vehicles, 5.5 percent collisions with other vehicles, 9.1 percent collisions with fixed objects, and 5.0 percent were noncollision. The importance of the pedestrian in fatal accidents is evident.

A tabulation of the persons killed in these accidents showed 57.5 percent pedestrians, 16.3 percent drivers, and 22.4 percent passengers. Apparently it is safer to be a driver than to be a passenger. A special tally including only accidents of the type likely to result in death to the occupants of the vehicle, and only cases in which the evidence indicated that the driver was accompanied by others, showed 59 driver deaths and 218 passenger deaths. Even if some allowance is made for possible failures to report the presence of uninjured passengers, the comparison is striking.

A minor but suggestive analysis was made of the relationship between the driver and the owner of vehicles involved in these accidents. Of the passenger cars, 60.9 percent were driven by the owners, 25.7 percent by friends of the owners, 4.1 percent by employees, 2.2 percent by members of the family, and 7.0 percent by persons whose relationship was unknown. One driver (0.1 percent) was operating a rented car. The percentage of borrowed cars, implying lack of familiarity on the part of the drivers and perhaps a degree of irresponsibility, seems significantly large.

On the other hand, 95.8 percent of the drivers claimed more than a year's driving experience. About 30 percent were less than 25 years old.

The reports included 108 cases in which the driver was intoxicated or had been drinking and 63 cases in which the pedestrian was in the same condition.

The contributing causes determined for each accident represent the judgment of those in charge of the study after examining all of the available evidence. The data emanate from a number of sources, and there is no uniformity in the definition of the various causes and circumstances. Factors such as "speed excessive for conditions" or "driver's negligence" represent someone's judgment as to what occurred and are necessarily indefinite of interpretation. Table 3, however, is valuable for showing the relative importance of certain attendant circumstances.

DISCIPLINARY ACTION

A study of these serious accidents creates a definite impression that our police, courts, and motor-vehicle administrators too often fail to impose penalties in reasonable proportion to the offense against public safety. This is partly attributable to the difficulty of obtaining evidence sufficient to convict and admissible in court under the rules of evidence, and partly perhaps to the lack of a criminal code designed to fit present-day motor-vehicle accident cases.

The court action in the cases of 905 drivers is shown in table 4.

TABLE 3.—*Frequency of occurrence of factors contributing to 892 fatal accidents*

	<i>Number of occurrences</i>
Speed excessive for conditions.....	636
Pedestrian's condition.....	417
Driver's negligence.....	361
Poor visibility.....	302
Temporary hazards in roadway.....	232
Pedestrian's faulty action.....	178
Driver's faulty action.....	155
Driver's condition.....	152
Faulty condition of motor vehicle.....	52
Faulty action of driver of vehicle other than a motor vehicle.....	21
Passenger's faulty action.....	16
Other factors.....	2
Total.....	2, 524

TABLE 4.—*Court action in fatal motor-vehicle accident cases*

	<i>Number of cases</i>
No record of any action.....	399
Cases not prosecuted.....	186
Cases nolprossed.....	35
Cases dismissed.....	95
Defendant judged not guilty.....	33
Defendant fined.....	95
Fine remitted.....	2
Jail sentence, less than 1 month.....	1
Jail sentence, 1 and under 6 months.....	10
Jail sentence, 6 and under 12 months.....	11
Jail sentence, 1 year or more.....	6
Jail sentence suspended.....	20
Cases pending.....	12
Total.....	905

In 614 fatal accident cases taken from the records of four State motor-vehicle departments, there were 57 in which there was no record of any action to suspend or revoke the drivers' licenses and 17 in which the record shows that no action was taken. In the remaining 540 cases there were 569 drivers penalized as shown in table 5.

INDIVIDUAL CASE STUDIES

It is believed that a careful reading of a large number of these individual case histories will give a clearer realization of the accident problem in present-day highway traffic than an impersonal statistical classification. A critical study of the entire collection leads to a number of general but rather clear-cut observations.

A frequent element in these accidents is unreasonable speed; but it appears qualitatively only. It is almost impossible to get any accurate quantitative idea of speed from the records as they stand. In many cases, it is true, there are statements incorporated in the report as to the speed at which the vehicles involved were traveling. These reported speeds, however, very often seem absurdly low in the light of other circumstances, and we are forced to the conclusion that in this respect the records are wholly unreliable.

TABLE 5.—*Suspension and revocation of drivers' licenses in fatal-accident cases*

Disciplinary action:	Number of cases
License suspended, less than 1 month.....	64
License suspended, 1 and under 3 months.....	146
License suspended, 3 and under 6 months.....	75
License suspended, 6 months or more.....	100
License suspended for period not stated.....	70
License revoked.....	114
Total.....	569

It is impossible to gather from the data any idea of what might be accepted as reasonable speed limits, either generally or locally. Even when the speed at which the vehicle was traveling is clearly reported, the only conclusion is that such speed was, under the circumstances cited, too great for safety.

Another factor in many accidents is conspicuously lacking in the reports from which these cases have been taken. This is the effect on driving hazards of the physical condition of the street or highway. It is usually possible to get the character of surface and width of pavement, but information as to other conditions, such as trees, poles, buildings, and steep gradients, is generally lacking.

In only the rarest cases is information given about the mechanical condition of the car or cars involved. Evidence in this respect is, of course, often destroyed in the accident, but, even under favorable circumstances, no investigations or tests are usually made.

A disturbing feature of these accident histories is the astonishingly light character of punishment of drivers for carelessness which results fatally. In case after case of those recorded in this study the offender is let off with either no penalty or a nominal one. Often he does not even lose the license to drive which has been given him by the State, but if he does it is usually only a short time before he gets it back. It would appear that a much more rigid procedure should be followed in the matter of license restriction on drivers.

A number of cases, selected more or less at random, are here given as illustrative of the type of information which can be obtained from existing records.

CASE G-21

B, northbound, and C, eastbound, collided at a rural intersection. Each driver admitted that he saw the other, and each said that he expected the other to stop. B's wife and C's wife were killed. B's daughter was injured.

The accident occurred at 10:15 p. m. in May. There were no obstructions to view at the intersection, but it was dark and there were no street lights. The weather was clear and the road surface dry.

The two cars crashed into a fence at the northeast corner, coming to a stop there. The entire front end and the left front fender of B's car and the right side and front of C's car were badly damaged.

The police card indicates that B did not have the right-of-way. There was no arrest and no court action.

This is a rather clear-cut case. The outstanding factor appears to be the personalities of the two drivers. "Each said that he expected the other to stop." Each belonged to the dangerous class of those who believe in putting the solution of every situation up to the other man.

CASE D-9

C, a 62-year-old man, riding an unlighted bicycle, was struck by B, who was intoxicated, after dark, at 4:55 p. m. in December.

The accident occurred during a rainstorm on a straight State highway in a rural residential district. The road is 28 feet wide and of macadam construction.

B testified that he had left home after he and two other men had consumed a pint of whisky among them. He claimed he was operating north at about 20 miles an hour when he saw the bicyclist ahead of him, about 6 feet from the east shoulder. B said he applied his brakes, swinging right, but struck and ran over the bicycle. His car then went off the road into a lot. He admitted that his windshield wiper was not working when the accident occurred.

B stopped a truck driver who took C to a hospital. B then went home where he was later apprehended by police. The coroner found him criminally responsible for C's death. In court, he pleaded not guilty to charges of driving to endanger life, with death resulting, and leaving the scene of the accident. The court found him guilty of leaving the scene of the accident and fined him \$100 and costs. He appealed the case, which, in June 1937, was still pending. The motor-vehicle department suspended his license.

In March 1929, B was reported by police for speeding in a zoned area. In December of that year, the motor-vehicle department called him for a hearing on a reckless driving charge. In January 1930, he was fined for passing a red light.

Weather conditions here appear to have been unfavorable, and the windshield wiper was not functioning properly. The driver admittedly had been drinking. The fine imposed seems rather light, considering the seriousness of his offense and his previous record for reckless driving.

CASE F-234

B, eastbound on X pike, had just passed an east-bound trolley car when he struck and killed C, a 52-year-old female pedestrian who was waiting for the trolley about 6 feet from the south curb, according to the police officer who investigated the case.

The accident occurred at 6 p. m. in November on a straight, two-lane, through route of macadam construction. It was dark; the weather was clear and the road surface dry.

B testified that, because he was slightly blinded by the bright headlights on an approaching car, he did not see the pedestrian until it was too late to avoid striking her. The investigating officer reported that B was driving at about 30 miles an hour and that C became confused when she saw the car approaching.

The coroner exonerated B. The motor-vehicle department took no action against him. In 1928 B had struck a pedestrian but was not arrested.

We cannot point to any outstanding cause for this accident. An unprotected streetcar loading zone, blinding headlights, and a confused pedestrian may be mentioned as contributory circumstances, but it is of the type usually set down as "unavoidable." The coroner exonerated B, and the motor-vehicle department permitted him to continue driving despite his record of having hit a pedestrian on a previous occasion.

CASE E-107

While attempting to rush C, his 2-year-old boy, to the hospital, B lost control of his car and crashed into a tree at the right side of the road. B, his wife D, and C were killed. B's two other children were critically injured.

The accident occurred at 5 p. m., in October. The road was concrete with dirt shoulders. The weather was clear and the road surface dry.

According to a newspaper story written at the time, one of the surviving children testified that previous to this accident C had been jerked from the car when the door opened. He had been pulling at the handle, she said. B jammed on his brakes, put the injured child in the car, and started for the hospital at high speed.

A police investigator reported that the car traveled north on the left side of X Road. After passing several cars, B swerved to the right to avoid oncoming traffic, struck the dirt shoulder on that side and lost control, finally striking a tree. A newspaper story stated that B was trying to pass a car on the right when he struck a tree and plunged into a ditch.

B was speeding and waving his handkerchief when he lost control of the car. The inspector said the speedometer read 88 miles an hour after the crash.

Although the speedometer reading after an accident is meaningless, there is plenty of evidence that B was traveling at a dangerously high speed. B had a temperament, excitable, highly nervous, unstable or irresponsible, which made him, under the stress of unusual circumstances, a highly dangerous driver. This and similar cases raise the question of whether it is possible to detect such unfitness at the time application is made for a driving license.

CASE Q-1

B, a 23-year-old boy, who had been drinking, was driving his car south on X Street at 20 miles an hour, when he struck C, an 85-year-old female pedestrian. B claimed he did not see the woman, but merely felt the impact. C was rendered semiconscious, and later died.

The accident occurred at 2:20 a. m., in January. The weather was cloudy, the road surface icy. There were good street lights.

Police arrested B on charges of assault and battery, driving without a license, and being drunk in a public place. On the day after the accident, the assault and battery charge was changed to manslaughter.

The coroner reported that B could not have avoided the accident. The court fined him \$10 for being drunk in a public place; the other charges were filed away.

Here then is a combination of an icy roadway, alcohol, and a pedestrian who, at her advanced age, should probably not have been abroad at 2:20 a. m. Although B had been drinking, the only penalty imposed was a fine of \$10 for being drunk in a public place. The difficulty of proving intoxication may account for the failure of the authorities to make the more serious charge of drunken driving. The chances of conviction by a jury on a charge of manslaughter were probably remote, especially after exoneration by the coroner.

CASE Q-2

Cars operated by B and C collided at the intersection of X and Y Streets. D, a 69-year-old occupant of C's car, received fatal injuries.

The accident occurred on a cloudy day in January. The road surface was dry and without defects. X Street carried double trolley tracks.

B, a woman driver, was operating her car south on X Street at about 35 miles an hour. She failed to stop for the boulevard stop sign at the Y Street intersection, and the front of her car crashed into the left side of C's car, which was heading east on Y Street at about 30 miles an hour.

Police arrested B 5 days after the accident on charges of manslaughter and disregarding a stop sign. The coroner reported that B's negligence had caused D's death. The court filed the manslaughter charge, but fined B \$20 for disregarding the stop sign.

The fine of \$20 for disregarding the stop sign was the only penalty which B had to pay.

CASE C-3

B, age 22, who admitted he had been drinking earlier in the day, drove his car into a canal, thinking it was a continuation of the roadway. C, a 19-year-old boy, and D, a 40-year-old woman, both passengers in the car, were drowned.

The accident occurred at 8:30 p. m., in August. It was raining and dark.

B testified that he had taken four or five glasses of beer at a picnic that day. He had left for home at about 7 p. m., he said, accompanied, by C, D, and B's brother. All four sat in the front seat, because the rumble seat provided no protection from the rain.

B's brother was dropped to get some cigarettes, B stated, and since there was no available parking space, B drove around, intending to pick him up later. B said he made a right turn on X street and then another right turn into an alley heading toward the canal. His lights went out twice, he said, and he replaced the fuses each time. He then proceeded, driving about 20 miles an hour, toward what seemed to him to be the lights of a gas station.

According to a sketch B drew for his accident report, the road makes a sharp right-angle turn, then runs parallel to the canal. Not realizing he was not following the road, he said, he drove into the canal. He said he remembered pulling at D's dress, but could not free her.

C's father testified that during a rainstorm at a later date, he examined the location of the accident. He was convinced, he said, that a driver could not see clearly at this point, since the road curves, and it is possible to mistake the canal—which is practically on a level with the road—for a macadam pavement. He stated that there were no signs or guard rails there. When B's car was raised, he said, it was in second gear, with the lights still burning.

The coroner and the district attorney reported that no criminal charge was pending or contemplated against B. The motor-vehicle department suspended his license, but on receipt of the coroner's report and a letter from the district attorney, it was returned, pending a hearing. It was permanently returned, following the final hearing, a month and a half later.

B had previously been fined for having more than three passengers in the front seat. His license had been suspended for a short period for this offense.

A highway unprotected against what must have been an obvious hazard, namely, the canal, appears to be the chief cause here. Darkness and rain, driving too fast for visibility, and, possibly, alcohol were contributing factors.

CASE H-135

B was driving east at 50 miles an hour on a wet pavement when his right wheels went off the road. The car began to skid, crossed the road, skidded sideways along the north shoulder, finally striking a tree. The center of the left side of the car struck the tree. B was killed and a passenger was injured.

The accident occurred at 4:30 p. m. in August, on a 20-foot wide concrete through route in a rural district. The weather was clear.

Police concluded that B had been driving too fast for conditions and was responsible for the accident. There was no police or court action.

The primary cause here is probably inattention or carelessness, which permitted the car to leave the pavement. Excessive speed for a wet roadway is also assumed. Inadequate shoulder design or maintenance may have contributed to loss of control, though there is no definite evidence to this effect in the record. There was no

police action, for the obvious reason that the driver was killed in the accident.

The detailed results of the study have been published as indicated on page 1.

INVESTIGATION AT THE SCENE OF THE ACCIDENT

Available reports on rural highway accidents are usually made by the drivers involved or by police officers untrained in methods of investigation. They cannot be depended upon to supply reliable evidence of a sort which tends to incriminate or which requires the observation of circumstances not superficially obvious. Police departments in an increasing number of cities have found that the investigation of motor vehicle accidents on the spot by specially trained mobile squads is a most effective means for determining the facts and prosecuting the persons at fault. Similar investigation of rural accidents, it is believed, would be very desirable for research into causes and as an aid to law enforcement.

A research project was accordingly planned to test the feasibility of a study of rural accident causes through technical investigations at the scene of accidents as soon as possible after their occurrence. Cooperation of the Michigan State police and the International Association of Chiefs of Police permitted some enlargement of the program, which developed three more or less distinct phases: (1) A study of methods for the technical investigation and analysis of motor-vehicle accidents, (2) a study of the existing accident reporting in the State, and (3) an analysis of drivers' records, based on nearly 55,000 violation tickets previously issued by the State police. The International Association of Chiefs of Police assumed the responsibility for educating and training the troopers in the approved methods for investigating and reporting rural highway accidents.

FINDINGS

1. Accident investigation on a State-wide highway system comparable to that in cities where accident prevention bureaus have been formed will require more adequate personnel and equipment than are now generally available in a State highway patrol.

2. The work of a highway patrol on accident investigations cannot be most efficiently performed when the time of the officers is divided among many matters.

3. Because of the large mileage of roads to be covered, and inadequate means of communication, the immediate investigation of rural accidents by an "on-call" accident squad except on limited areas, is of doubtful feasibility.

4. A serious handicap to accident investigation on rural roads is the time that usually must elapse before accident investigators can reach the site, during which much evidence may be obscured or obliterated.

5. In order to assemble all the facts concerning a highway accident it is necessary that the physical evidence be accurately noted and competently interpreted along with the statements of participants and witnesses.

6. Case histories of accidents secured in this manner will be of great value in a fundamental study of highway accident causes.

7. Of 143,600 drivers recorded by the Michigan State police since 1931 as having received violation tickets or summonses or having been involved in accidents, only 2.3 percent have more than one record card against them. No significant relation was found between the number of violation tickets or summonses recorded against a driver and his recorded accident experience.

MICHIGAN STATE POLICE ORGANIZATION

The Michigan State police had its inception in a program of public protection during the World War and functioned for several years as the Michigan State troops. Reorganized in 1921 as a department of safety it carried on its first safety work in the schools in 1925. In 1935 it was reorganized as the Michigan State police. Among the duties of its safety and traffic division are to direct campaigns of safety and traffic education and to supervise the activities of the department in administering the laws pertaining to the proper recording of accident reports and statistics pertaining thereto.

For police work, the State of Michigan is divided into eight districts, each containing one or more posts. The total strength of all the posts was, on May 25, 1937, less than 200 officers and men. East Lansing post, in district no. 1, covers approximately 2,660 square miles and includes Ingham, Clinton, Eaton, and portions of Barry, Ionia, Gratiot, and Shiawassee Counties. Within this area are 3 United States and 28 Michigan routes, which together with the county roads total about 7,000 miles of highway. The authorized strength in November 1936, was 19 officers and men. Five automobiles and five motorcycles are available for transportation and patrol work.

Table 6 is a summary of the activities of the East Lansing post for the month of November 1936. It is introduced to show the multiplicity of duties required of the present small force of 19 men which is responsible for control of traffic and accident prevention on 7,000 miles of road.

TABLE 6.—*Analysis of daily records, East Lansing post, month of November 1936*

Authorized number of men.....	19
Average number of men on duty.....	12.6
Total hours road patrol.....	1,060
Total hours on complaints.....	1,477
Total miles highway patrol.....	18,570
On trunk highways.....	13,763
On county highways.....	4,807
Total complaints.....	246
Traffic.....	78
Other.....	168
Violation tickets issued.....	36
Traffic summonses.....	21
Traffic arrests.....	6
Accidents reported.....	55
Property inspections.....	97
Liquor inspections.....	50
Cars investigated.....	256
Operators license hearings.....	4
Fingerprinted and photographed.....	37
Assistance to local officers.....	10
Assistance to sheriffs and Federal officers.....	40

TABLE 6.—*Analysis of daily records, East Lansing post, month of November 1936—*
Continued

Value of property recovered.....	\$2, 410
7 automobiles.....	\$1, 750
Other property.....	\$660
Oil inspections (10 cars)..... gallons.....	69, 507
Total number of arrests.....	72
Convictions.....	37
Discharges.....	9
Pending.....	15
Turned over to local police.....	11
Leave of absence (man-days).....	112
Sick and accidents (man-days).....	2
Other, authorized (man-days).....	110

Accidents are generally reported by telephone by one of the persons involved, by a witness, or by someone among the first to arrive at the scene. Minor accidents are often reported directly at a police post by the driver. Other reports are received from hospitals and garages, which are required by law to report when injured victims and wrecked vehicles are brought in for attention.

If a patrol car is in the vicinity of an accident when it is reported, a radio message from the radio and communications division is broadcast directing that car to investigate the accident. If no car in the field is available, one is sent from the nearest post.

The Michigan State police are able to investigate approximately two-thirds of the reported rural accidents. The remainder are taken care of by the various county sheriffs.

TECHNICAL STUDY OF ACCIDENTS

The major objective of this project was the study of accidents on the spot by a technically trained investigator. In nearly every accident there were physical clues as to just what happened, how it happened, and where it happened. Marks on the road surface or shoulder, the actual point of impact, the position of the cars after impact, and the kind and extent of damage to the vehicles involved were the chief clues which had to be observed, recorded, and fitted together in order to determine just what had occurred. In the evaluation of these data training and experience in engineering and methods of analysis are most valuable. To determine properly just what series of causes were responsible for each accident, every factor had to be included no matter how minor it might appear.

Through cooperation of the Michigan State police it was possible for the investigator to go out with a patrol car during periods of high-accident frequency. While this method of getting to the scene of an accident involved a great deal of time it worked out much better than waiting at the East Lansing post for accident calls.

The detailed investigations made were sufficient to indicate the practicability and value of this type of work, as a supplement to police investigations, and to develop a technique. The relative infrequency of accidents in rural areas apparently precludes, for economic reasons, the maintenance of special police squads for accident investigation only. Further research of the type conducted under this project is desirable, but as a general practice it will be necessary to place continued reliance on the regular State police officers, and to bring their accident investigating and reporting to the highest possible standard by training and supervision.

The technique which was developed by this study for the investigation and analysis of highway accidents will undoubtedly be modified materially with more extensive experience. The procedure was as follows:

Upon arrival at the site the investigator first gave any emergency assistance possible. Thereafter he examined the road surface for skid marks and measured them before others were superimposed upon them. If any vehicle had run off the road, the shoulder was examined for skid or tire marks. The actual point of impact was next determined by means of skid marks, broken glass, and pavement scars. The positions of the vehicles were noted and their distances from the point of impact measured.

Whenever possible the investigator determined the condition of the brakes, lights, steering mechanism, and horn, and visibility through the windshield. He talked with the drivers, witnesses, or persons first arriving at the scene of the accident. He found out how much driving experience each operator had, whether city or rural, and his general driving habits, especially with respect to speed.

Finally he made notes of the roadway characteristics such as alignment, surface type, condition and width of roadway and shoulders, and the physical characteristics beyond the shoulders such as ditches, fixed objects, trees, or guard rails. He determined the approximate sight distance from both directions. He noted the type of traffic control or aids that were present such as signs, signals, center-line or lane markings, and whether or not they were functioning.

If the accident involved a pedestrian, any marked deficiencies in his physical condition, eyesight, hearing, and dexterity, were determined by inquiry.

Sketches with notes were found to be very valuable. Pictures of the accident scene, of the vehicles themselves, and of skid marks were sometimes taken. They proved of value in showing the results to the best advantage and in subsequent study.

For recording the results and circumstances, the present accident report form of the Michigan State police was used. This was supplemented by a detailed written report which included a description of the roadway characteristics, a sketch of the scene showing the various positions of the vehicles involved, pictures, if available, statements of drivers or witnesses made to the police officers subsequent to the time of the accident, and a determination of the probable speed of the vehicles from physical evidence collected and interpreted according to the best judgment of the investigator.

Since it was not the aim of the investigator to place the legal responsibility but to determine the cause of the accident from consideration of all the contributing factors, any accident report to be of value had to be further analyzed and the relative importance of these factors estimated. An analysis sheet was used to set down the relative importance of these different factors. After checking over all the items on the list of factors which might be contributory, the investigator recorded these in the proper place on the analysis sheet giving such weight to the proximate and remote causes as seemed justifiable from the information and conclusions. In an aggregate of 30 cases studied prior to June 1, 1937, 76.0 percent of the responsibility was attributed to the driver, 5.3 percent to the car, and 10.6 percent to the road, leaving 8.1 percent miscellaneous and undetermined. On a further

break-down the 76.0 percent assigned to the driver was allotted 35.2 percent to hazardous violation of road laws and 40.8 percent to drivers' errors of judgment. Further experience and study are needed to determine the feasibility and value of this method of analysis, which is an adaptation of that developed for the study of aircraft accidents by the National Advisory Committee for Aeronautics.

It is interesting to compare the investigator's opinion as recorded above with a simple numerical count of the proximate causes of the 30 accidents. There were 23 causes listed which appeared a total of 120 times. That is, there were 120 causes for 30 accidents, or an average of 4 per accident. These are distributed as follows: Driver, 75.8 percent; car, 3.3 percent; road, 15.8 percent; and miscellaneous, 5.1 percent.

STUDY OF VIOLATION TICKETS AND SUMMONSES

The troopers of the Michigan State police are instructed to watch for violations of traffic laws and to issue violation tickets or summonses or to make arrests, depending upon the seriousness of the offense. It was thought that a study of these tickets and summonses in conjunction with the department's records of drivers that had been involved in traffic accidents might indicate whether or not potential high-accident drivers could be singled out by means of the tickets standing against them.

Approximately 55,000 violation tickets, summonses, and arrest reports for the past 3 years were sorted, checked, and filed in the "Persons involved" file of the safety and traffic division, which contains a record of all persons involved in accidents reported to the State police. Following this, the entire file was searched for persons having two or more violations, two or more accidents, or one or more violations together with one or more accidents charged against them. Out of an estimated 143,600 motor-vehicle drivers in the "Persons involved" file, there were only 3,260 or 2.3 percent for whom two or more cards were filed, and only 0.7 percent with 3 cards or more. The data are clearly too scattered to warrant any conclusions as to the proportion of accident or violation "repeaters" among an estimated total of 1,800,000 licensed drivers in Michigan.

Further analysis of these records showed no significant relation between the number of violation tickets received and the accident experience of the individual drivers. This again may be attributed to the relatively small number of cases in the statistical sample.

SUPPLEMENTARY DATA

Additional statistical data, and a number of illustrative cases of accident investigation and analysis have been published as indicated on page 1.

STATE MOTOR-VEHICLE ACCIDENT REPORTING

The fundamental importance of accident records and data in any systematic study of traffic conditions and measures for their improvement appeared to justify a further research project for the investigation of data available from official sources. The object of this project was the study of State laws, regulations, and practices relating to the reporting of motor-vehicle accidents, and of the uses that are made of

accident data. Specifically, the project included the following major considerations.

1. Legal and administrative requirements for reporting motor-vehicle accidents.
2. Office procedure for handling accident reports.
3. Uses of accident reports and data.

Thirty-eight States were visited to obtain first-hand information on the practices followed by motor vehicle, State police, highway patrol, and highway departments in reporting motor-vehicle accidents, handling reports, summarizing accident data, and using the reports and data. These States included all that could be covered by the field investigator on a carefully planned itinerary within the time available, as follows:²

Alabama.	Maine.	Oklahoma.
Arizona.	Maryland.	Oregon.
California.	Massachusetts.	Pennsylvania.
Colorado.	Michigan.	Rhode Island.
Connecticut.	Minnesota.	Texas.
Delaware.	Missouri.	Utah.
Georgia.	Nebraska.	Vermont.
Idaho.	New Hampshire.	Virginia.
Illinois.	New Jersey.	Washington.
Indiana.	New Mexico.	West Virginia.
Iowa.	New York.	Wisconsin.
Kansas.	North Carolina.	Wyoming.
Louisiana.	Ohio.	

A limited amount of legal data readily available from other States without personal investigation has been incorporated in the report.

FINDINGS

1. An examination of the motor-vehicle laws for all the 48 States reveals that 19 do not have central control over accident reporting by motor-vehicle operators. Fourteen States require no report from motor-vehicle operators to any State or local agency.

2. In 10 States accident reports submitted by motor-vehicle operators are open to public inspection.

3. In 17 States the ratio of reported personal-injury accidents to fatal accidents ranges from 5 to 44, indicating wide differences in the completeness of reporting.

4. Thirteen of the 38 States visited do not check their fatal-accident reports against the death records of the State health department.

5. Great variation exists among the States in defining a reportable accident.

6. No two of the 38 States visited use the same accident-report form or monthly summary form, though there are many important similarities.

7. Twenty-eight of these 38 States publish a monthly summary of accident statistics.

8. Various systems of filing and cross-indexing accident reports are employed.

² The survey was made between December 15, 1936, and May 1, 1937. There were 43 State legislatures in session during the early months of 1937, and the enactment of new legislation subsequent to the collection of information for this report has altered conditions in certain details. An effort has been made to revise all data as to legal requirements to include the new legislation, but it is obvious that such revision is impossible in regard to the administrative procedure developed under these laws. Report forms, for example, filing systems, and methods of accident analysis change from time to time, more or less independently of legal regulations. The data cited herein, therefore, do not portray conditions precisely as they exist at the present time, though the general situation is described with fair accuracy.

9. Very few States are making adequate use of their accident reports and data for accident prevention.

ACCIDENT REPORTING

In only 15 of the 48 States does the law require that motor-vehicle operators shall report accidents directly to a central State agency such as the motor-vehicle department, the highway department, or the State police. Eight additional States require reporting to a central agency, except that accidents within incorporated cities and towns are to be reported to the local police who are required to forward the reports, or copies, to the State agency. Five States require reporting to the local police or peace officers, who must forward the reports, or copies, to the State.

One State requires reporting to a central agency, except that accidents occurring in its largest city must be reported to the city police, who need not forward reports to the State. Five States require reporting only to the local police or peace officers, who are not required to forward any reports to the State.

Fourteen States do not require motor-vehicle operators to make any report of accidents.

Only 15 States therefore have complete central control over accident reporting by motor-vehicle operators, 14 States have partial central control; and 19 States have no central control. It is virtually impossible to obtain any perspective of the traffic-accident situation in the States that do not have some degree of central control over accident reporting by motor-vehicle operators.

In every State where there is such an organization, the State police department or highway patrol reports accidents occurring outside of incorporated cities or towns. These reports are by no means complete as to the number of accidents, however, especially of minor ones, because of lack of personnel, large territory to be patrolled, and conflict of other duties.

In 24 States, accident reports submitted by motor-vehicle operators are held in strict confidence for use only by the State. In 10 States that require reporting in some manner or another, the reports are open to public inspection. Keeping reports confidential, State authorities believe, encourages motor-vehicle operators to report accidents, and discourages "ambulance chasing" and unnecessary litigation.

A study of the accident records in 17 States reveals that the ratio of reported personal-injury accidents to fatal accidents varies from 5 in Minnesota and North Carolina to 44 in Massachusetts. Other States in the group have ratios of 6, 6, 6, 8, 8, 9, 12, 13, 15, 15, 15, 21, 27, and 39.

Of the States that require motor-vehicle operators to report accidents directly or indirectly to a central State agency, 15 make accident report form blanks readily available through local police, justices of the peace, motor clubs, insurance companies, hospitals, and other agencies directly concerned with motor-vehicle accidents, and thereby make accident reporting by motor-vehicle operators easier and more convenient.

At least four States that were visited have taken definite steps to educate motor-vehicle operators as to the need for reporting and how to make out reports on accidents. At least three more have instituted

measures to secure more accurate reporting of the exact location of accidents. Studies of accident reports by location, with a view to removing hazards and improving conditions at specific locations, demand accurate information on the location of accidents.

In the matter of following up on the various sources of accident data, the 38 States stand as follows: 12 States make further inquiry into accidents reported in newspapers; 11 follow up on all delinquent operators who are known, from any source, to have been involved in accidents; 8 check against coroners' records; 3 investigate reports from garages on automobiles that appear to have been involved in serious accidents. The States that have established follow-up practices regard them as necessary for securing a greater volume of accident reports. A follow-up on all delinquent drivers in time results in a greater tendency of drivers to report voluntarily accidents in which they are involved.

The State health department receives reports on all deaths occurring within the State, whatever may be the cause. For this reason, 25 of the 38 States visited compare their fatal accident records monthly with those of the health department. The check-up rarely fails to disclose a number of deaths, attributed to motor-vehicle accidents, that have not been included in the records of the State motor vehicle accident reporting agency. Such a check-up, therefore, is a valuable means for insuring the accuracy of statistics on motor vehicle fatalities.

UNIFORMITY OF RECORDS

It is very difficult, if not impossible, to consolidate or compare in detail many of the motor-vehicle accident tabulations from different States, due to the lack of uniformity in the reporting or summarizing of the data.

There is, first, variation among the States as to what kind of accidents must be reported. Twenty-six States require the motor-vehicle operator to report accidents involving death, personal injury, or property damage. Eight States require reports only on accidents involving death or personal injury. Fourteen States require no reporting by operators. Furthermore, of the 26 States that require reports on accidents involving only property damage: 3 require the total damage to be \$10 or more, 4 require the total damage to be \$25 or more, 14 require the total damage to be \$50 or more, 1 requires the total damage to be \$100 or more, 3 require the total damage to be any amount, and 1 requires that a vehicle be rendered inoperative.

Another phase of accident reporting where uniformity is definitely lacking is in the report form and monthly statistical summary. No two of the States visited use the same report form or monthly summary, although in general arrangement and in many of the most important items of information there is much similarity. In 17 States the motor-vehicle operator need not indicate his driving experience when reporting an accident. Fourteen States call for this item of information, but summarize the data in 10 different classifications of length of experience. In four States the approximate speed of the vehicles is reported. Only five require data as to the nature of personal injuries. In the matter of ages of the persons injured or killed, a study of the summary forms shows that 11 different age groupings are used, while 12 States do not report by age groups. It is obviously impossible to combine these summaries and retain a

classification by reasonable age groups. Seventeen different age groupings are used for the age of the driver, while nine States do not ask the driver's age. In 13 States the causes and circumstances are tabulated separately for fatal accidents, nonfatal personal injury accidents, and those involving property damage only. Fatal and nonfatal accidents are separated in nine States. Total accidents only are tabulated in six States, and in two States fatal accidents only. Without knowledge of the States' requirements for reporting it is impossible for anyone reading the statistical summaries to know whether or not "nonfatal" includes property-damage accidents.

ACCIDENT ANALYSIS

Tabulation, analysis, and publication of motor-vehicle accident facts are required by law in 16 States. All of these States carry out the letter of the law. However, a number of other States engage in this activity without legal prompting as the need has become manifest. Twenty-six of the 38 States visited tabulate and publish monthly statistics on all reported motor-vehicle accidents (this includes the 16 States required to do so by law) and 2 States on fatal accidents only. Three States publish annual summaries only. Seven States publish no statistics on accidents. Comprehensive annual reports on accident statistics are prepared by only 9 of the 38 States visited. Compilation and publication of current facts on the causes and circumstances of accidents are essential to education in traffic safety, and to the engineering and enforcement agencies working to solve the traffic-accident problem.

Two methods of summarizing accident data are used: The hand tally and the machine tabulation. The hand-tally method is simpler and perhaps cheaper for use in straight, simple summary of data from relatively small numbers of accident reports. The mechanical-tabulation method is more complex but lends itself to efficient use in quickly and accurately summarizing large quantities of data. The mechanical method also makes possible numerous detailed analyses and correlations of accident facts, that would not be feasible by the hand-tally method. Twenty-two of the thirty-eight States visited employ the hand-tally method. Eleven use the machine-tabulation method. The remaining five States make no statistical summaries. It is noteworthy that the States using mechanical tabulation have been content for the most part with simple monthly summaries such as the other States have made by hand tallying. Very few have taken advantage of the machine to make detailed analyses of accident causes and circumstances, and these only to a limited extent.

The States with the best accident-reporting systems file and cross-index reports in such manner as to serve a maximum of uses—for location studies, for disciplining the driver, for enforcement on the road, and for statistical analyses of data. However, there is considerable variation among the 38 States visited in the methods used for filing the original accident reports and cross-indexing. Ten States file the original reports by serial number, 7 by date, 12 by location, 8 by name of person reporting, and 1 files by no special system. Twenty States cross-index by names of persons involved, of which four also cross-index by location and one by date. One cross-indexes by date and location and one by location. Sixteen States do not cross-index their accident reports.

The ultimate purpose of accident reports and facts is their use in the generally recognized phases of accident-prevention work. How generally the States are adhering to this purpose can be gathered from the following table showing specific uses to which accident reports and information are put in the 38 States visited:

Uses	Number of States	
	Yes	No
Special statistical summaries.....	6	32
Accident spot maps.....	24	14
Special location studies.....	4	34
Driver discipline.....	7	31
Enforcement studies.....	3	35

A detailed report on this study has been published as indicated on page 1.

OFFICIAL INSPECTION OF VEHICLES

During the course of these studies it became apparent that the matter of compulsory inspection of motor vehicles was a controversial question, principally for lack of evidence on such points as cost, effectiveness in preventing accidents, organization needed, and specifications covering inspection.

To ascertain the general significance of such inspection as is now required, a survey was made, by correspondence, among the 15 States having laws State-wide in scope, applicable to all motor vehicles, now effective or in process of being made effective. These States are Arkansas, Colorado, Connecticut, Delaware, Maine, Maryland, Massachusetts, Nebraska, New Hampshire, New Jersey, New Mexico, Pennsylvania, Utah, Vermont, and Virginia.

In 1 State inspection is required three times annually, in 9 twice annually, in 4 once annually, and in 1 as fixed by the commissioner of motor vehicles. In each of the 15 States the inspections cover brakes, lights, and steering gear. Most of the States also test or check horns, windshields and wipers, mirrors, and registration plates. Other items checked by one or more States each include tires, exhaust system, engine and serial numbers, window glass, signals, reflectors, wiring, wheel alinement, springs, and flares.

In 12 States, the inspections are made at designated garages. Three States own and operate their own inspection stations.

Seven States report percentages of failure on first examination ranging from 34 to 87. Failure to pass inspection after an opportunity has been given for adjustment or repair generally results in automatic suspension of license or other procedure for removing the car from the road. Only four States report as to the number of cars taken from the highways. Two report, respectively, "very few," and "negligible." One reports "about 40 cars" during the 1937 campaign, and one reports 5 percent.

Evidence of approved condition is usually indicated by a sticker affixed to the windshield. Cars not displaying stickers during a specified period are subject to investigation by police or motor-vehicle inspectors.

A detailed report of this survey has been published as indicated on page 1.

HIGHWAY POLICING

A final question that took on added importance as these studies progressed, is that of policing the highways. Evidence of weakness in enforcement of traffic safety regulations was revealed by several sources. Accident reports fail to cover all legally reportable accidents. Vehicles with conspicuously defective equipment are frequently found on the highways. The study of fatal accident case histories revealed great leniency in court action, due in part, it is believed to lack of adequate and active police investigation and assistance in prosecution.

Thirty-four of the forty-five State highway patrol organizations have full police powers. This authority imposes on the personnel a multiplicity of duties other than those generally associated with highway accident problems. In a study here reported there was clear evidence that an apparently very well organized and efficient State police was unable to handle satisfactorily those duties related directly to highway matters because of other entirely justifiable but conflicting responsibilities.

The personnel available for highway patrol duty is generally so limited that the mileage of road per patrolman is too large. A comparison of road mileage on the State highway systems with the total personnel of the corresponding patrol organizations shows a range of from 6 miles per man to 1,262 miles per man, with an average of 82. This comparison takes no account of the fact that there are many miles of highway not on the State system, or that only a part of the entire force is available for patrol duty at any time. For the States in which the highway patrol is responsible only for traffic law enforcement, the ratio ranges from 25 to 612 miles of State highway per man.

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The work reported herein was carried on under the direction of the Bureau of Public Roads, Thomas H. MacDonald, chief. The Bureau obtained the cooperation of a number of organizations and institutions that had previously worked with outstanding effect in the particular field investigated. Special arrangements were made with the Highway Research Board of the National Research Council to permit the interested organizations already engaged in cooperative research with the Board to be drawn upon for active participation in the investigation. For the Bureau of Public Roads the research program was under the general direction of Mr. E. W. James, chief of the Division of Highway Transport, assisted by Mr. William G. Eliot, 3d, highway economist. For the Highway Research Board, Mr. Roy W. Crum, director, was in charge, assisted by Dr. H. M. Johnson, research associate.

In order to benefit from the best thought of those who have given long and careful study to problems of highway safety, an advisory committee was invited to assist in the planning of the research and the preparation of the reports. The committee, composed of nationally recognized authorities in the field of traffic safety and representatives of organizations long active in the work, included the following members:

Dr. H. C. Dickinson, National Bureau of Standards, chairman
of the Highway Research Board.

Prof. C. J. Tilden, Yale University.
Dr. Alvhh R. Lauer, Iowa State College.
Dr. Harry R. DeSilva, Harvard Bureau for Street Traffic Research.
Prof. Robbins B. Stoeckel, Yale University.
Sidney J. Williams, National Safety Council.
Burton W. Marsh, American Automobile Association.
L. W. McIntyre, American Motorists' Association.
Dr. Ralph Lee, Automobile Manufacturers' Association.
Col. A. B. Barber, Chamber of Commerce of the United States.
W. J. Davidson, Society of Automotive Engineers.
A. W. Whitney, National Conservation Bureau.
Arthur W. Brandt, American Association of State Highway Officials.
John Q. Rhodes, Jr., American Association of Motor Vehicle Administrators.

Studies were conducted with the assistance of organizations represented on the advisory committee and that of numerous other organizations.

The report on the status of uniform motor-vehicle traffic laws was prepared by Mr. L. E. Boykin, Chief of the Division of Laws and Contracts, Bureau of Public Roads.

The research on accident records of drivers was under the direct supervision of Dr. H. M. Johnson. Miss M. J. Cairns, formerly supervisor of Suspensions and Financial Responsibility in the Connecticut Department of Motor Vehicles, was in responsible charge of compiling the necessary data on operators' records from the official files of that department. Valuable assistance in the statistical analysis was given by Dr. Percy Wells Cobb, formerly associate professor of biophysics in Washington University Medical School, and Professor Tobias Dantzig of the University of Maryland.

The study of case histories of fatal accidents was directed by Prof. C. J. Tilden of Yale University. Mr. C. Russell Graff, previously with the Connecticut State Highway Department, supervised the field work of compiling the records. The statistical summaries were prepared by Mr. Rolland S. Wallis, formerly of the Pennsylvania Economic Council.

The project on accident investigation, in cooperation with the Michigan State police, was directed by Prof. W. Sherman Smith, who was granted leave of absence for the purpose by the University of Toledo, assisted by Mr. Howard W. Tillapaugh, on leave of absence from the Iowa Engineering Experiment Station.

The study of State motor-vehicle accident reporting was made by Mr. Peter J. Stupka, formerly with the safety and traffic engineering department of the American Automobile Association.

Data regarding the official inspection of motor vehicles were supplied by the motor vehicle authorities in the States concerned, through Mr. A. W. Koehler, executive secretary of the American Association of Motor Vehicle Administrators.